Ground Control Report

Wisconsin WROC – 3DEP | Dane County LiDAR 2017

1.1 Ground Control Design and Methodology

The ground control network and design used for the Dane County LiDAR acquisition was made up of calibration points, GPS base stations, NGS base stations, and independent check points from the vertical accuracy ground control survey. This report will focus on the LiDAR calibration points that were collected at 10 locations in and around the Dane County project area. The control points are used for QC checks and calibration of the raw point cloud and for additional vertical checks against the processed bare earth surface.

The ground control calibration survey was done in Wisconsin County Coordinate System-Dane County, NAD83 (2011), US survey feet; NAVD88 (Geoid 12B), US survey feet. The field work was conducted by Ayres Associates surveyors.

Control Summary and Methodology

Control Summary

Horizontal Datum:	North American Datum of 1983, 2011 Adjustment – NAD83(2011)
Vertical Datum:	North American Vertical Datum of 1988, GEOID12B
Rectangular Coordinate System:	Wisconsin County Coordinate System – Dane County
Used NGS Control?	☒ Yes ☐ No
List any NGS control points used:	**DF9643** COTTAGE GROVE S GPS, **DF9700** SPRINGFIELD W GPS, **DF9708** CROSS PLAINS GPS, **DF9720** PRIMROSE E GPS, **DF9768** FITCHBURG S GPS, **DF9774** BROOKLYN GPS, **DF9915** DUNKIRK N GPS, **DF9920** STOUGHTON GPS, **DF9925** RUTLAND N GPS, **DF9944** SUN PRAIRIE E GPS, **DF9946** SUN PRAIRIE W GPS, **DF9978** DEERFIELD S GPS, **DG4920** MONONA GPS, **DH5046** MAZOMANIE S GPS, **DH5448** WINDSOR W GPS, **DH5453** DANE E GPS, **DH5546** COLUMBUS CENTRAL GPS, **DH5703** HAMPDEN S GPS, **NH1578** KOLLATH
Summary of control checks and calibration (if applicable):	See field notes for control checks on NGS monuments – No Calibration was needed
Survey Methods Used:	RTK GNSS using WISCORS network through VRS connection. Robotic total station methods where GPS was obstructed.
Equipment Used:	Trimble R10 GPS GNSS S/N – 5410456448 (Ayres #74.95) Trimble TSC3 Data Collector S/N – RS0NC10833 (Ayres #75.21) Trimble S6 Robotic Total Station S/N – 93410054 (Ayres #75.20) Trimble R8 GPS GNSS S/N – 4720132940 (Ayres #70.67) Trimble TSC3 Data Collector S/N – RS0NC10834 (Ayres #MAD) Trimble S6 Robotic Total Station S/N – 93410503 (Ayres #76.06)

Crew Chief Notes

Placed PK nails or Spikes at all locations measured

Recorded appropriate: NVA (Bare Earth & Urban) and VVA (Forested, Swamp/Wetland, Tall Weed/Crop). Took (4) pictures of each point – one from each cardinal direction.

All work was performed in and referenced to NAD83(2011), NAVD88(2012), GEOID12B, Wisconsin County Coordinate System(WCCS) Dane County Zone in US Survey Feet.

Established horizontal and vertical coordinate values on the points by a minimum of two – 180 epoch observations with separate initializations using RTK GPS on the WISCORS network. The resultant coordinates and elevations provided in the deliverables are an average of the two observations

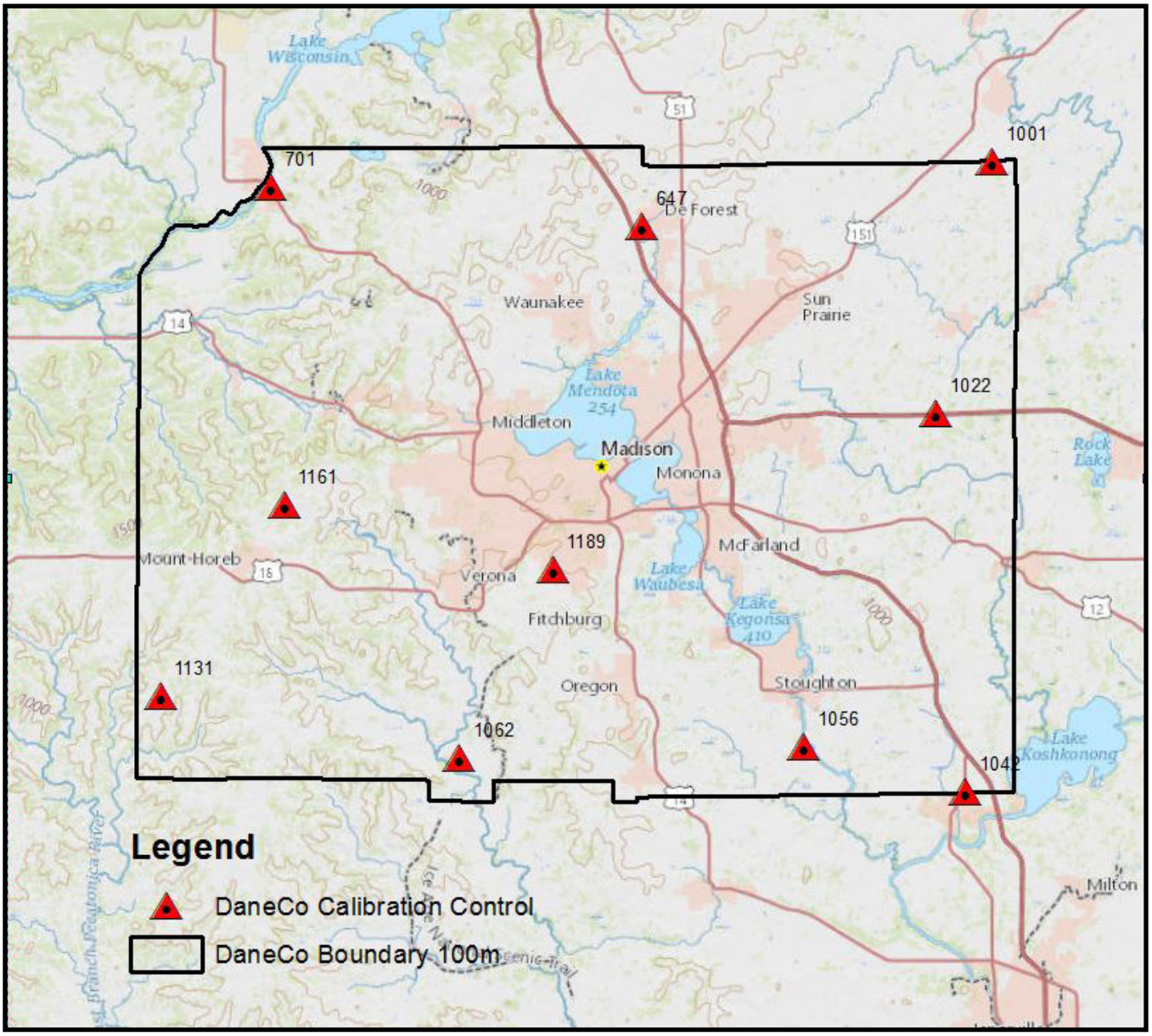
Check shots were taken on numerous NGS control points (See field notes) to verify that the values obtained are consistent with the datum/adjustment as described herein and meet the ±3 centimeter vertical accuracy requirement at the 95% confidence level

Points not able to be directly occupied by GPS means were measured using Total Station Methods from control point pairs set utilizing GPS methods outlined above

1.1.2 Control Layout

The locations were selected around the outer geometry of the project boundary and on major roads within the project area. This layout design is preferred when the calibration points will be used to check different areas across a large flight block. The control survey was conducted with a Trimble R-8 GPS receiver and a VRS connection with a TSC3 data collector.

1.1.2.1 Map of Dane County Calibration Points



1.1.3 Dane County LiDAR, Calibration Point Statistics

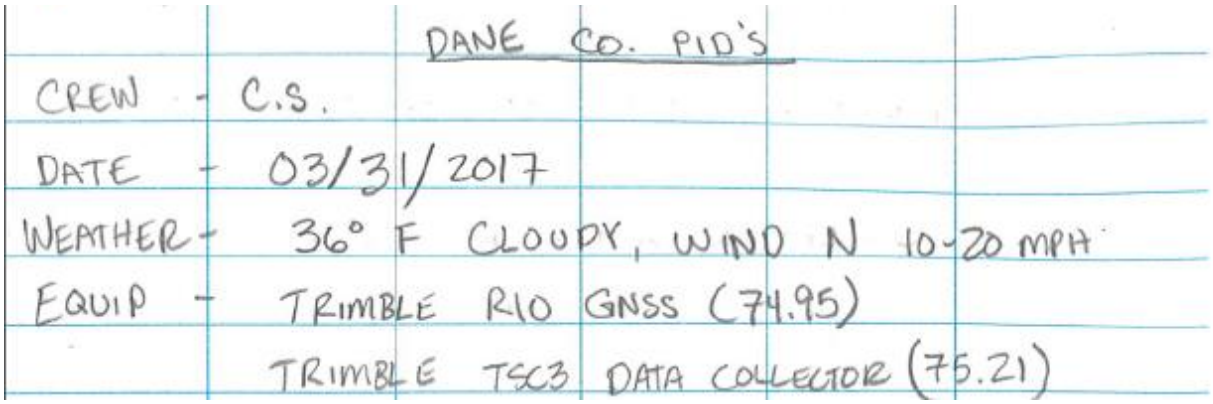
The final step in using the calibration points is to run a statistical comparison against the bare earth ground surface to confirm that the vertical accuracy is within specification. The follow results indicate that the overall RMSEz of the calibration points is 0.102'. This is a separate check as compared to the Vertical Accuracy Survey QA/QC report. These points are used in the calibration of the raw point cloud, and therefore are not an independent set of checkpoints like those used in the vertical accuracy testing.

1.1.3.1 Statistical Report for Calibration Points

Number	Easting	Northing	Known Z	Laser Z	Dz
1001	915684.788	559451.191	909.000	909.120	+0.120
1022	901434.826	495855.791	884.770	884.800	+0.030
1042	908646.422	400242.740	836.160	836.140	-0.020
1056	867871.752	411358.940	829.810	829.720	-0.090
1131	705346.267	424164.679	1150.930	1151.040	+0.110
1161	736618.553	472653.749	1129.360	1129.370	+0.010
1189	804585.135	456103.699	1048.070	1047.920	-0.150
647	827081.383	542955.128	952.740	952.930	+0.190
701	733063.366	552785.346	775.660	775.740	+0.080
1062	780697.934	408688.676	870.190	870.250	+0.060

Average Dz	+0.034 ft
Minimum Dz	-0.150 ft
Maximum Dz	+0.190 ft
Average Magnitude	0.086 ft
Root Mean Square	0.102 ft
Std Deviation	0.102 ft

1.1.4 Field Notes



DANE CO. PID'S

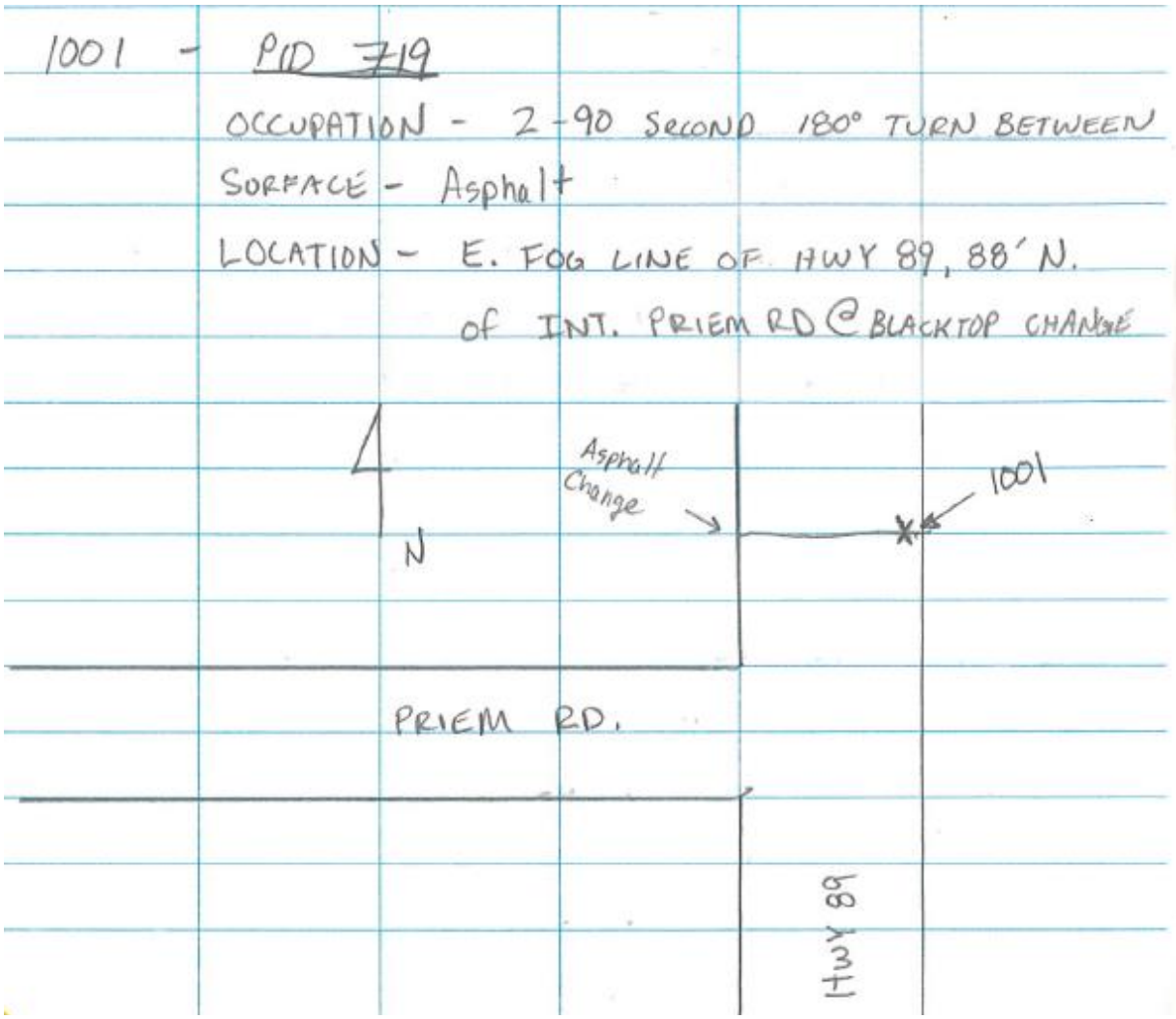
CREW - C.S.

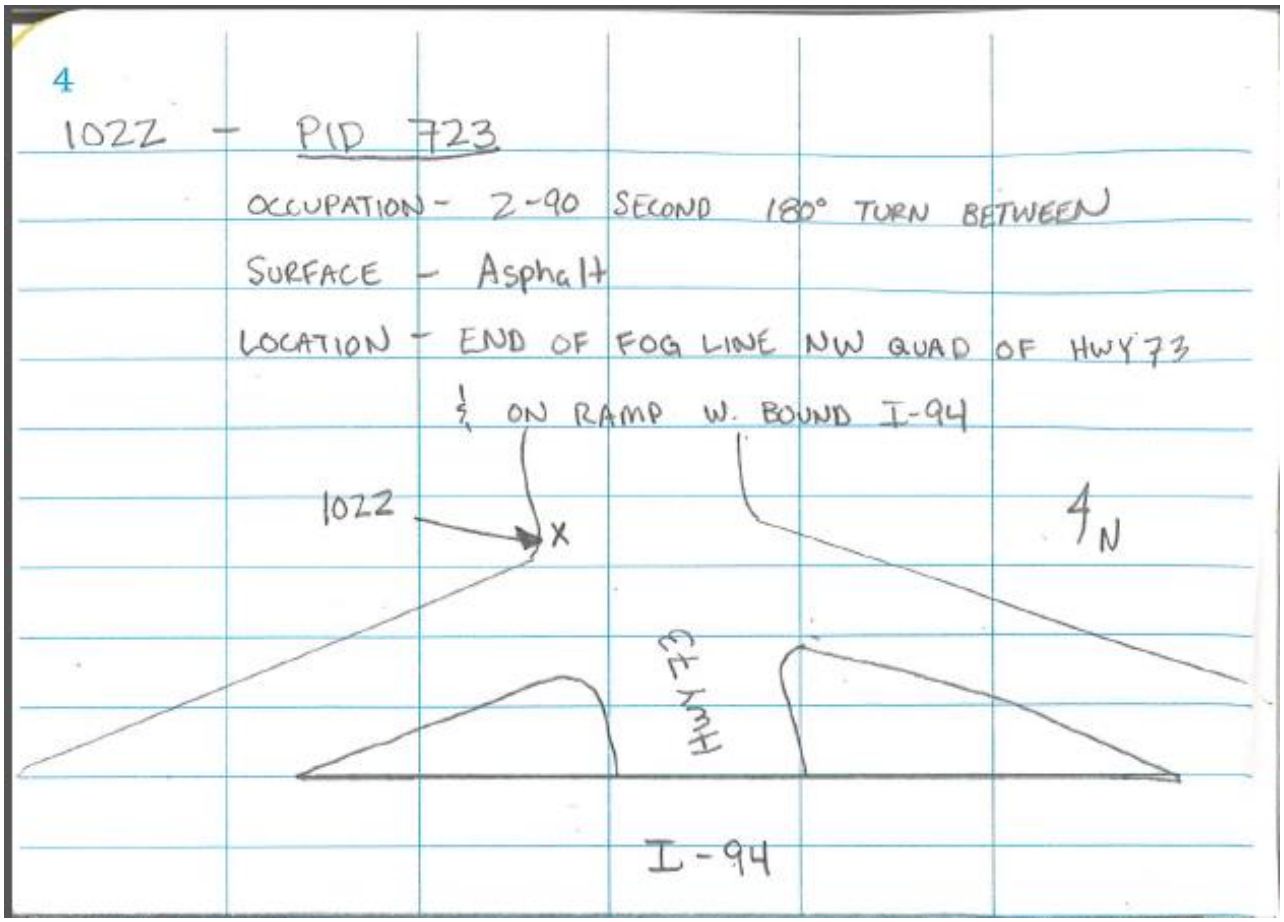
DATE - 03/31/2017

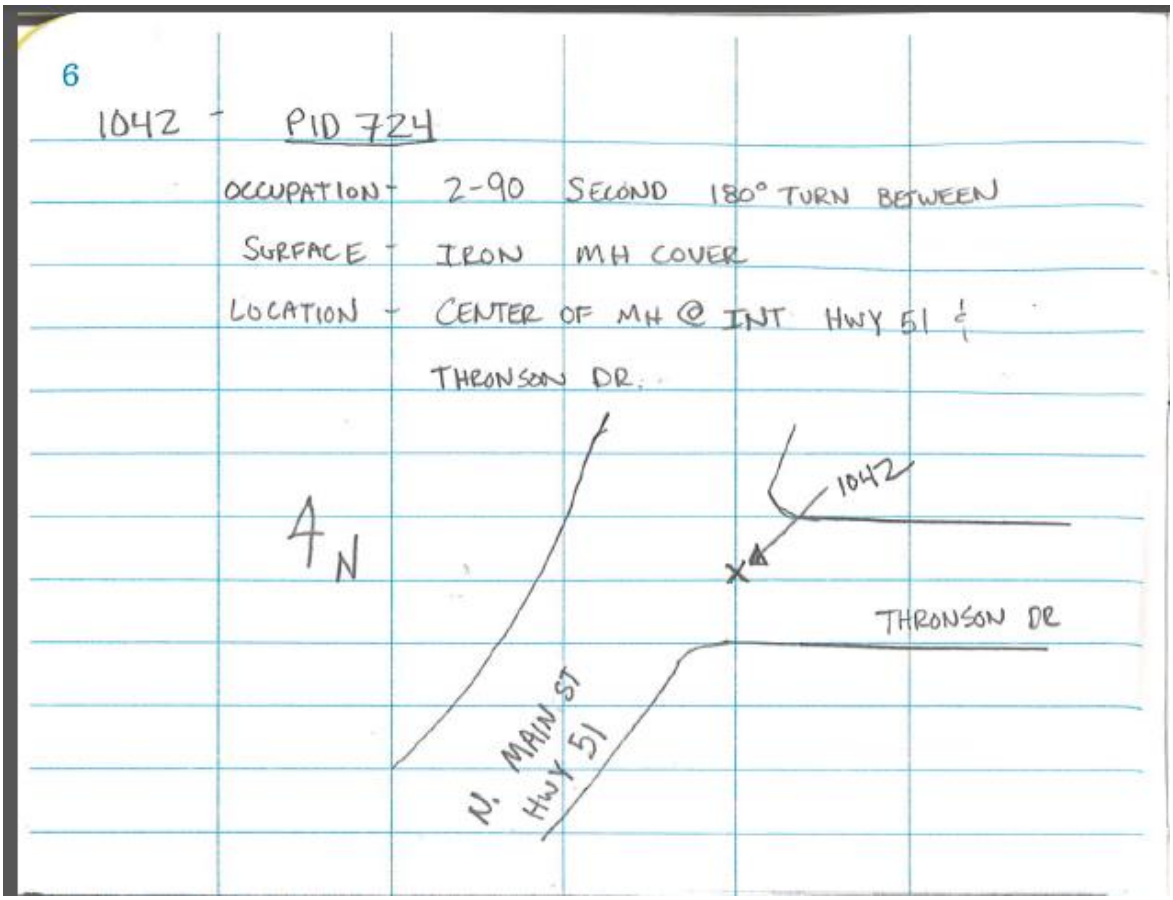
WEATHER - 36° F CLOUDY, WIND N 10-20 MPH

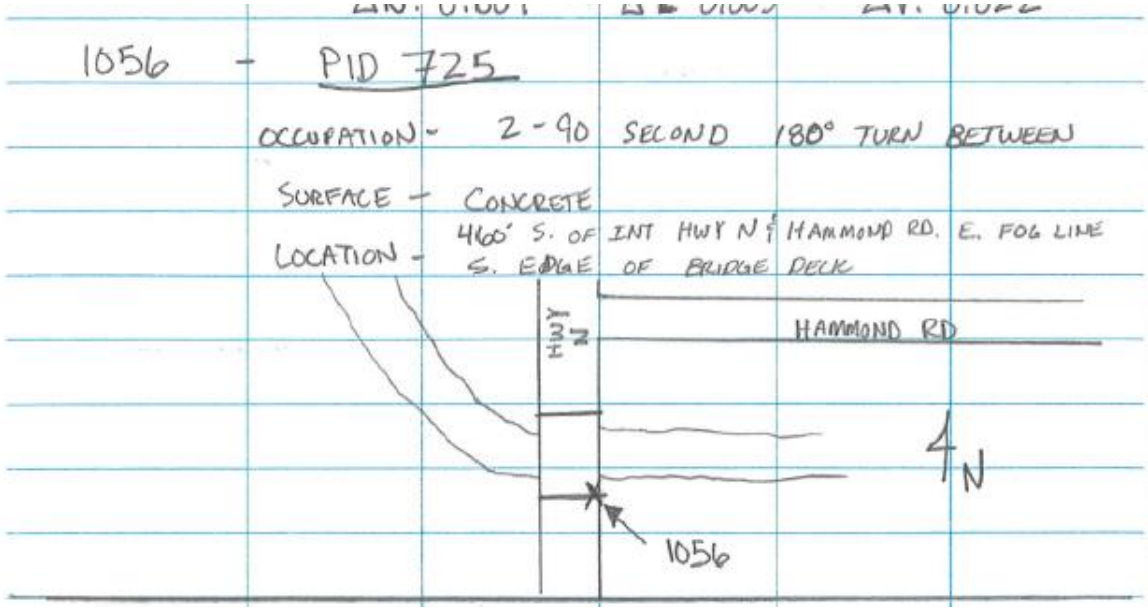
EQUIP - TRIMBLE R10 GNSS (74.95)

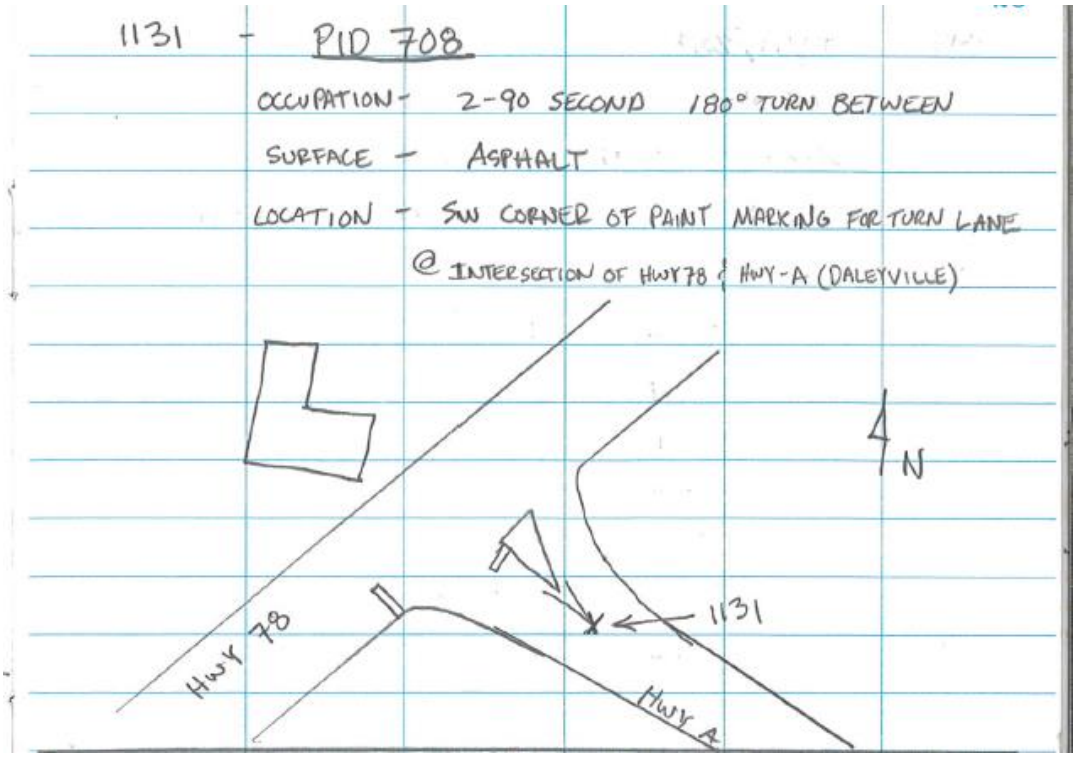
TRIMBLE TSC3 DATA COLLECTOR (75.21)

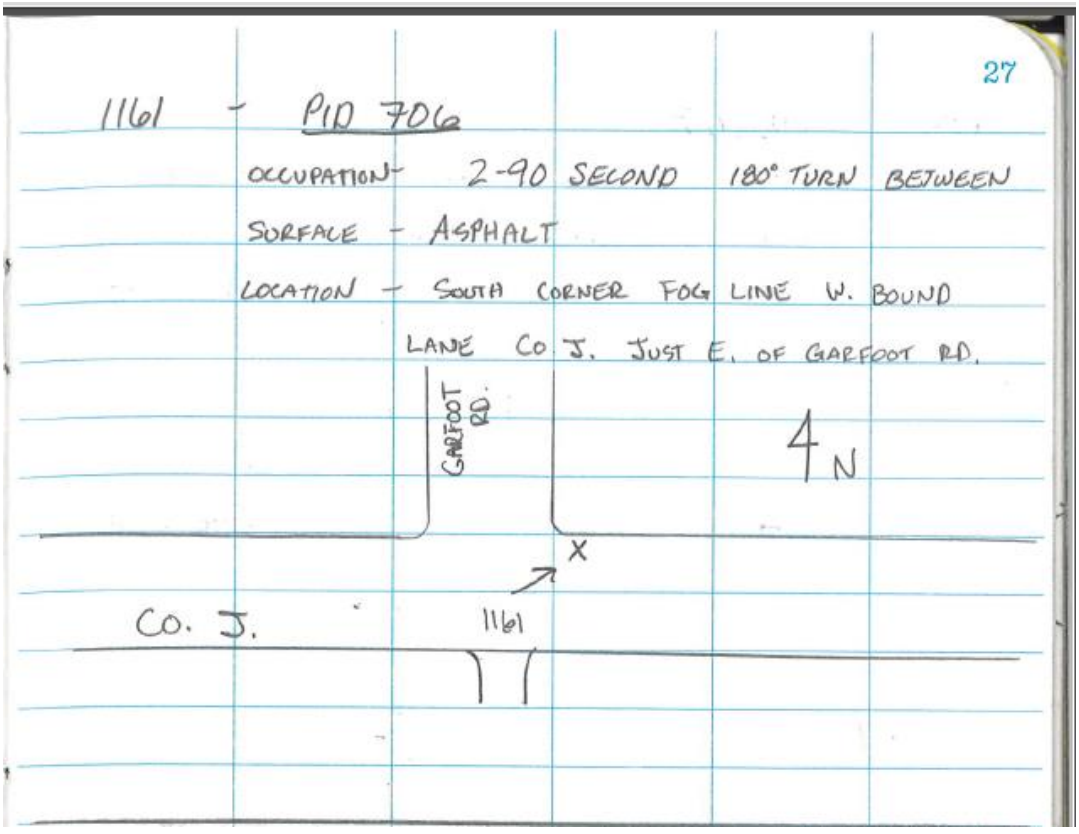



4
1022 - PID 723
OCCUPATION - 2-90 SECOND 180° TURN BETWEEN
SURFACE - Asphalt
LOCATION - END OF FOG LINE NW QUAD OF HWY 73
& ON RAMP W. BOUND I-94
1022
X
N
HWY 73
I-94

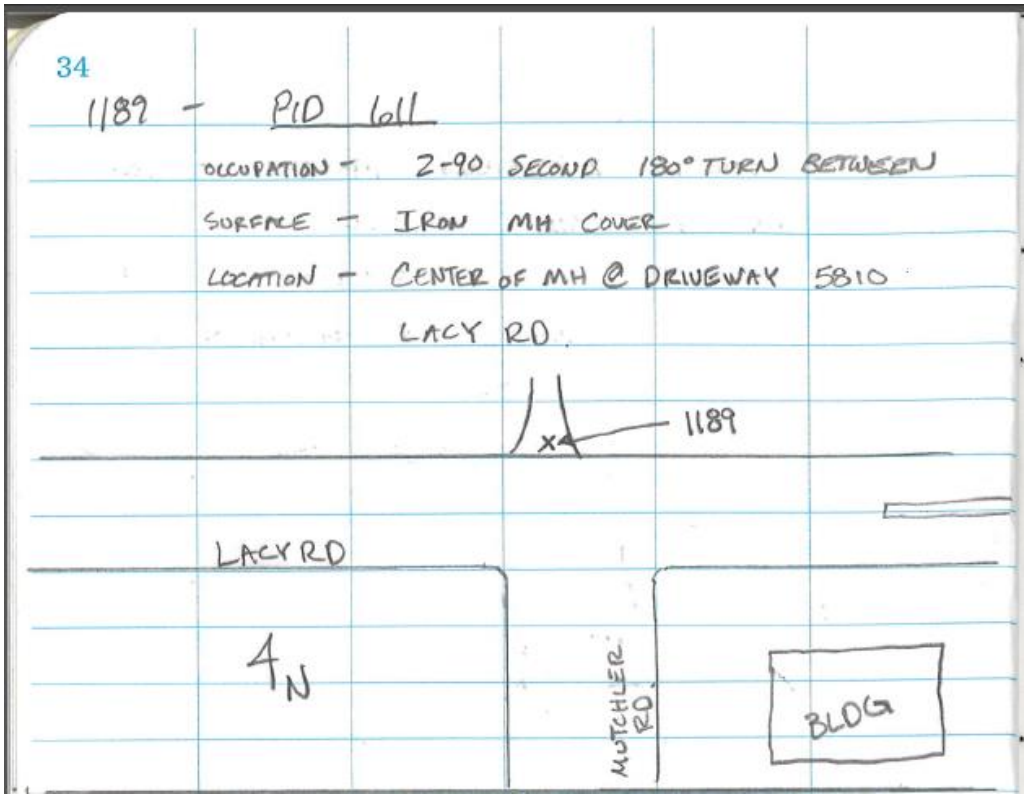

6
1042 - PID 724
OCCUPATION - 2-90 SECOND 180° TURN BETWEEN
SURFACE - IRON MH COVER
LOCATION - CENTER OF MH @ INT HWY 51 &
THRONSON DR.
N
1042
THRONSON DR
N. MAIN ST
HWY 51

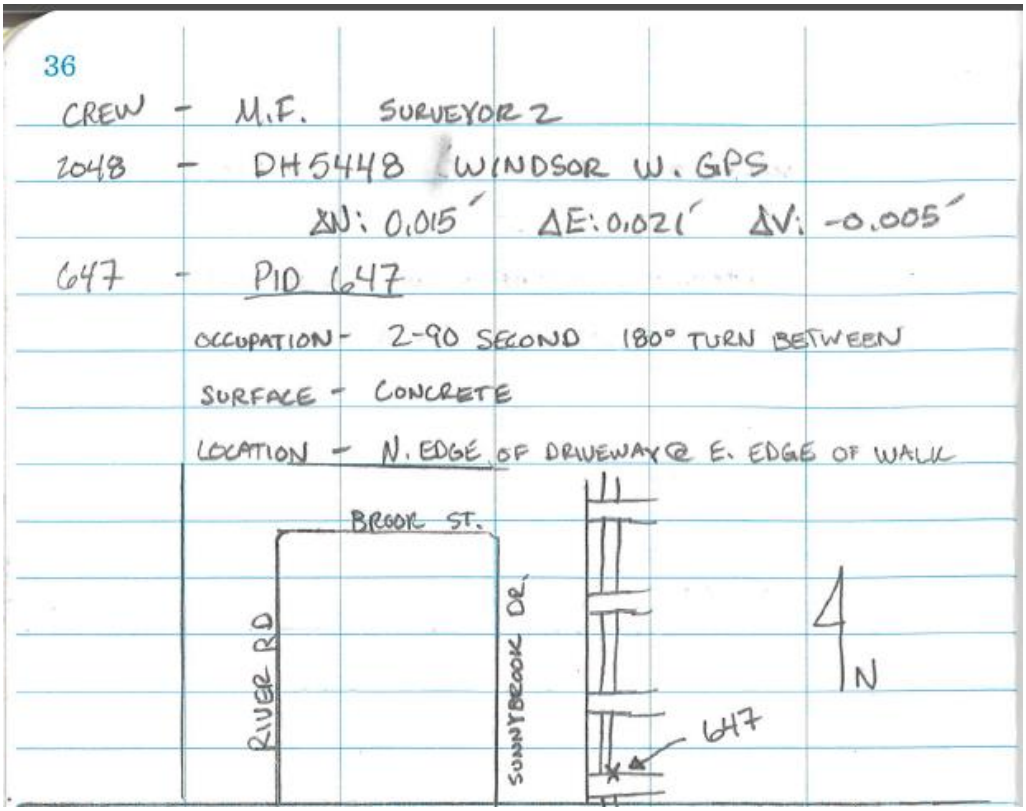

1056 - PID 725
OCCUPATION - 2-90 SECOND 180° TURN BETWEEN
SURFACE - CONCRETE
LOCATION - 4600' S. OF INT HWY N & HAMMOND RD. E. FOG LINE
S. EDGE OF BRIDGE DECK
HWY N
HAMMOND RD
N
1056

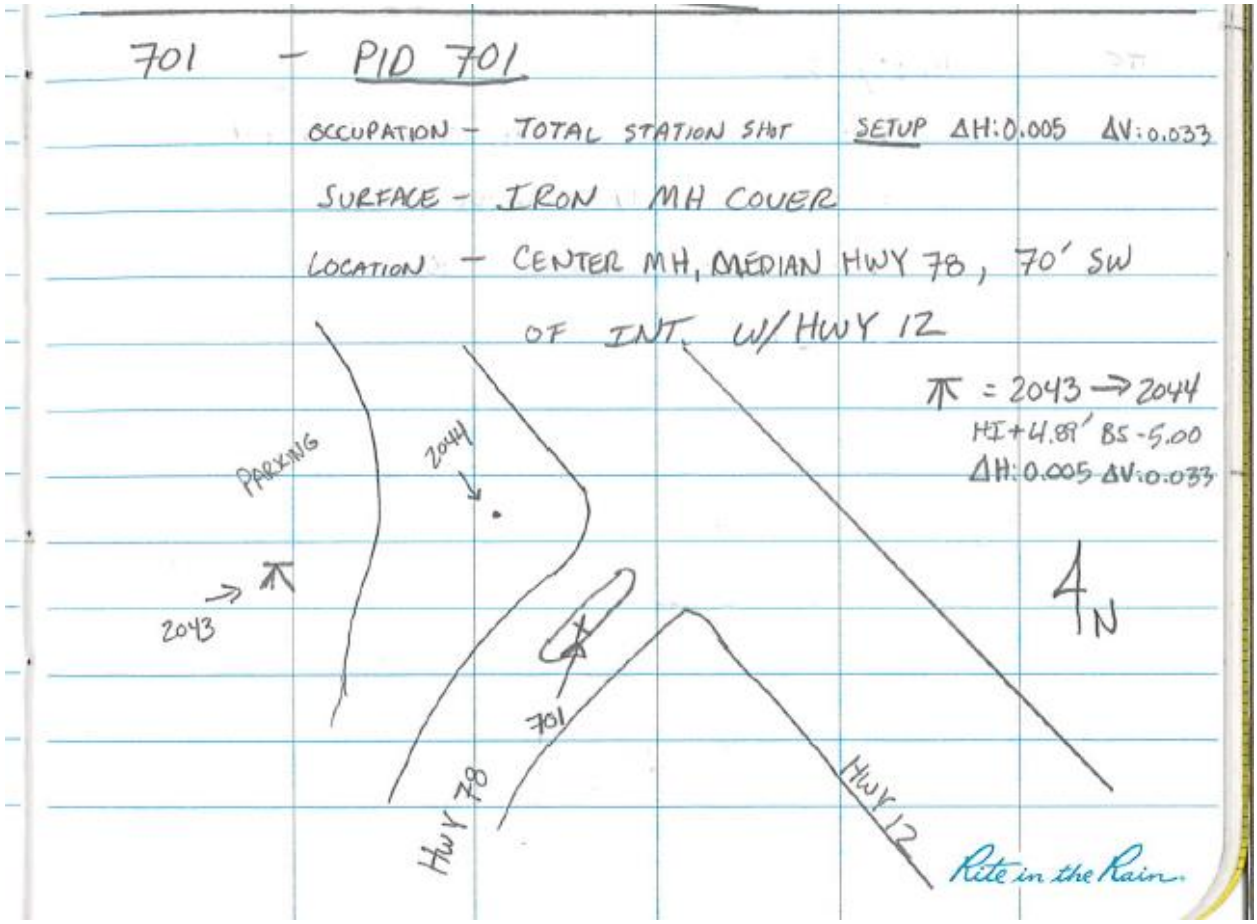

1131 - PID 708
OCCUPATION - 2-90 SECOND 180° TURN BETWEEN
SURFACE - ASPHALT
LOCATION - SW CORNER OF PAINT MARKING FOR TURN LANE
@ INTERSECTION OF HWY 78 & HWY-A (DALEYVILLE)
N
HWY 78
1131
HWY A

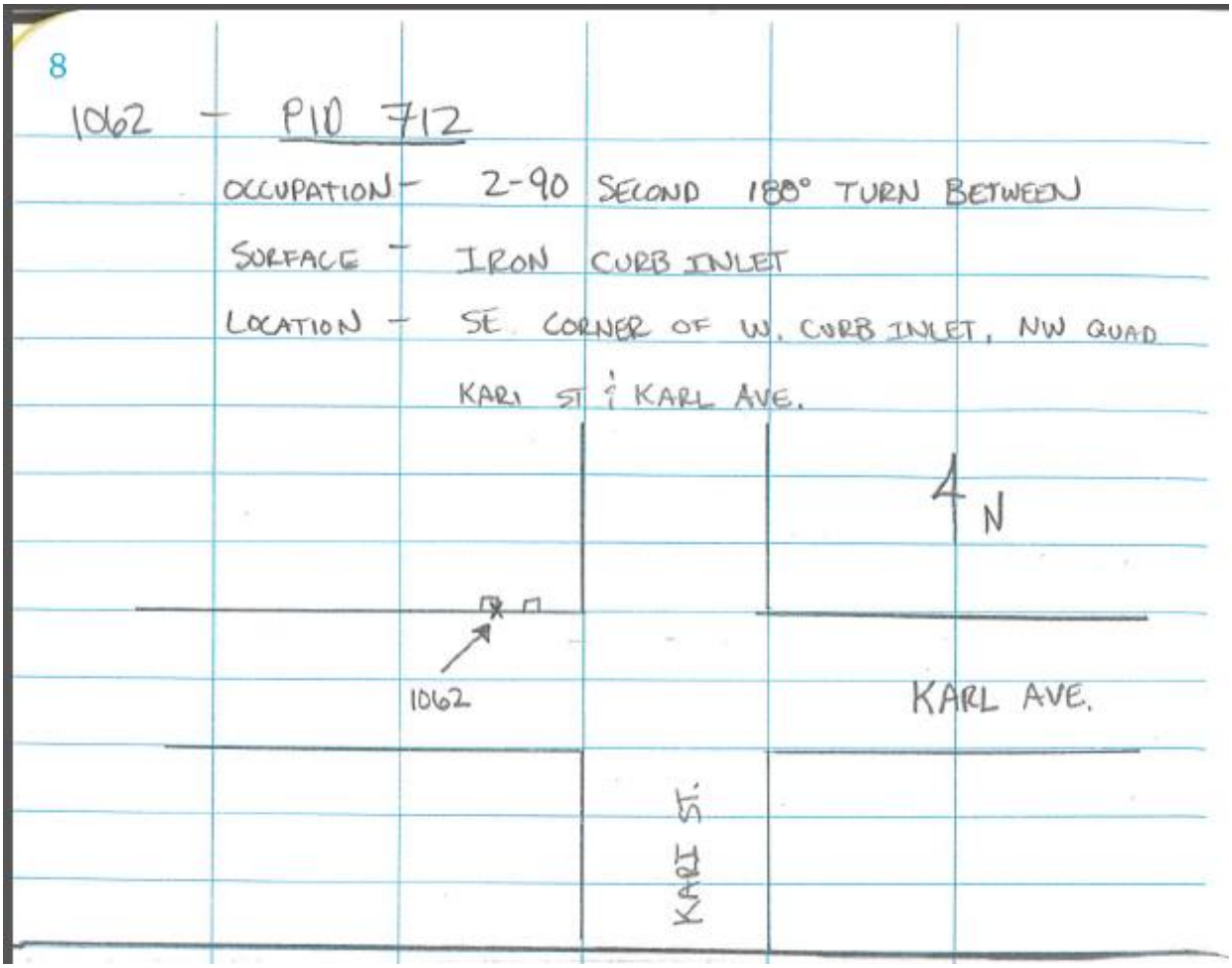

27
1161 - PID 706
OCCUPATION - 2-90 SECOND 180° TURN BETWEEN
SURFACE - ASPHALT
LOCATION - SOUTH CORNER FOG LINE W. BOUND
LANE CO J. JUST E. OF GARFOOT RD.
GARFOOT RD.
N
X
1161
CO. J.

Field Notes (Continued)






701 - PID 701
OCCUPATION - TOTAL STATION SHOT
SETUP ΔH:0.005 ΔV:0.033
SURFACE - IRON MH COVER
LOCATION - CENTER MH, MEDIAN HWY 78, 70' SW
OF INT. W/ HWY 12
π = 2043 → 2044
HI+4.89' BS-5.00
ΔH:0.005 ΔV:0.033
PARKING
2044
2043
701
HWY 78
HWY 12
N
Rite in the Rain.


8
1062 – PID 712
OCCUPATION – 2-90 SECOND 180° TURN BETWEEN
SURFACE – IRON CURB INLET
LOCATION – SE CORNER OF W. CURB INLET, NW QUAD
KARL ST & KARL AVE.
N
1062
KARL AVE.
KARL ST.

1.1.5 Field Photos

Point 1001

Point 1022

Point 1042

Point 1056

Point 1131

Field Photos (Continued)

Point 1161

Point 1189

Point 647

Point 701

Point 1062